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Diagnostic and prognostic value of scd163 levels in upper gastrointestinal bleeding

Value of sCD163 levels in upper gastrointestinal bleeding

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Abstract

Aim: Upper gastrointestinal endoscopy (an invasive procedure) is the gold standard for diagnosing patients with suspected upper gastrointestinal bleeding. In this study, oOur aim is to determine the value of sCD163 in upper gastrointestinal bleeding.

Material and Methods: In this single-center,e cross-sectional, prospective study, we aimed to evaluate the value of sCD163 as a non-invasive marker for diagnosing and predicting upper gastrointestinal bleeding. Patients aged ≥18 years who underwent endoscopy for suspected upper gastrointestinal bleeding and presented at the emergency department of Kanuni Sultan Suleyman Training and Research Hospital in the University of Istanbul Health Science were included in the study. Statistical analysis was conducted using the SPSS Statistics 26.0 program (IBM Inc., New York, USA). The study was conducted between January 8, 2019 and January 4, 2020 with 75 participants. Of these, 41 patients had upper gastrointestinal bleeding, and 34 were healthy volunteers.

Results: In the patient group, Glasgow-–Blatchford scores and sCD163 values were calculated for those with and without bleeding-related findings. Notably, the patient group had statistically significantly higher sCD163 levels than the healthy volunteer group healthy volunteers ($p < 0.05$).

Discussion: sCD163 may be a useful biomarker for diagnosing upper gastrointestinal bleeding and identifying the clinical process.

Keywords

Gastrointestinal Bleeding, sCD163, Scoring, Endoscopy

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Introduction

More than 75% of all gastrointestinal (GI) bleeding cases occur in the upper GI system, making this condition one of the most prevalent reasons for hospital admissions worldwide [1,2]. Patients with upper GI bleeding exhibit wide-ranging symptoms and clinical courses, ranging from asymptomatic occult bleeding to subclinical occult bleeding, anaemia and hypovolemic shock [3]. Many risk assessment scoring systems have been established to predict clinically significant outcomes, such as mortality, hospital-based intervention requirement, re-bleeding and hospitalizsation duration [4]. These scoring systems were classified into three, such as a classification that only requires endoscopic data, including endoscopic and clinical findings, and the scoring system, which is based only on clinical results [5]. In addition, some studies have reported on certain biomarkers that can may be useful for GI bleeding assessment.

One of these biomarkers is sCD163, which functions as a scavenger receptor during the endocytosis of the haemoglobin-–haptoglobin complex [6]. In this study, we aimed to investigate the value of sCD163 in diagnosing upper GI bleeding in patients who underwent endoscopy, independent of subjective parameters (e.g., the prolongation of the patient's waiting time for interventional procedures such as endoscopy, and the suitability of the conditions in terms of diagnosis and prognosis).

Material and Methods

Determination of study groups

This single-centere, cross-sectional and prospective study was conducted in the emergency department of Istanbul Kanuni Sultan Suleyman Training and Research Hospital, University of Health Sciences.

Ethical statement: Prior to participant enrolment, the Ethics Committee of Health Sciences University and Istanbul Kanuni Sultan Süleyman Training and Research Hospital approved our study (KAEK/2019.06.154).

The study was conducted between January 8, 2019 and January 4, 2020. The study It included patients presenting to the emergency department and undergoing endoscopy with a provisional diagnosis of upper GI bleeding and healthy volunteers. Based on the parameters of the initial laboratory tests, the Glasgow-–Blatchford score was calculated.

Exclusion criteria

For the upper GI bleeding or patient group, those who were aged <18 years, who had lower GI bleeding, who had oesophageal variceal bleeding, had malignancy-induced bleeding and were unwilling to participate in the study were excluded. For the healthy control group, we excluded those who were aged under <18 years of age, were pregnant, had a known comorbiditiesy and had signs of acute infection during enrolment.

Laboratory methods

Biochemical analysis

Venous blood was collected from both groups by routine phlebotomy in a 5 mL gel tube (BD vacutainer SST II Advance; NJ, USA) and a 2 mL anticoagulant tube (K2-EDTA; Becton Dickinson, NJ, USA). Samples placed in the anticoagulant tube were examined immediately. After completing the biochemical tests used in scoring the blood samples that were placed in the gel tube, we kept the remaining portion at room temperature for 20 minutes before being centrifuged at 3500 rpm for 10 minutes to obtain serum and plasma samples. Meanwhile, the remaining serum and plasma samples were collected in Eppendorf tubes and frozen at −80°C for enzyme-linked immunosorbent assay (ELISA). From the serum, white blood cells (WBC), haemoglobin, platelets and red blood cell distribution width were analyzsed by fluorescence flow cytometry (XN-2000; Sysmex Corp., Kobe, Japan).

ELISA analysis

The CD163 protein of all samples was analyzsed by the sandwich ELISA method in the Synergy HTX BioTek instrument (Biotek Instruments, Inc., Vermont, USA) using the SUNLONG brand CD163 ELISA kit (catalogue number: SL2931Hu). The intra-assay coefficient of variability (CV) of the kit is <10%, and the inter-assay CV is 12%.

Statistical analysis

Patients' age, sex, vital signs, medical history (chronic diseases), medication use, haemogram and biochemical parameters were recorded to calculate the Glasgow-–Blatchford score. In addition, endoscopy results were calculated and recorded using the Forrest scoring system. Especially, the CD163 levels were recorded.

Statistical analyses were completed in two study groups: the patient group (patients with upper GI bleeding) and the control group. The data were analyzsed using the SPSS Statistics 26.0 (IBM Inc., New York, USA). We present continuous variables as mean, standard deviation and median (Q1–Q3) values, and categorical variables as numbers (percentages). For the pairwise comparison of non-normally distributed continuous variables, we used Pearson's chi-square test. The relationship between numerical variables was determined by Spearman's correlation analysis. We also conducted receiver operating characteristic (ROC) analyses and identified the area under the curve values. Furthermore, the sensitivity, specificity and positive and negative predictive values (PPV and NPV, respectively) of sCD163 were determined by calculating the sCD163 cut-off value, and then compared between the Glasgow-–Blatchford and Forrest scoring systems. A p- value of <0.05 was considered statistically significant.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

Out of 75 included participants, 41 were patients with upper GI bleeding, and 34 were healthy volunteers. The patient group had more males than females (73.2% [n = 30] vs. 26.8% [n = 11]), whereas the healthy volunteer group had more females than males (61.8% [n = 21] vs. 38.2% [n = 13]). The mean age was 57.54 ± 2.99 years in the patient group and 45.50 ± 2.79 years in the healthy volunteer group, showing a statistically significant difference ($p < 0.05$). The distribution of endoscopy results by sex showed no statistically significant difference. Moreover, 9.8% (n = 4) of participants in the patient group demonstrated normal endoscopy results. Table 1 shows the demographics of the included participants and the sex distribution of the endoscopy results.

Table 1 shows the distribution of patient history and

Table 1. Characteristics of the study groups

	n	Age ± SD	Min	Max	p-value	Female	Male	p-value
SG	41	57.54 ± 2.99	21	85	<0.01[a]	11	30	<0.01[b]
CG	34	45.50 ± 2.79	20	80		21	13	
Forrest Classification	Normal	1[a]	1[b]	2[a]	2[b]	2[c]	3	
Female	2	1	1	0	1	3	3	0.173[a]
Male	2	5	8	3	1	1	10	
	4 (9.8%)	6 (14.6%)	9 (22.0%)	3(7.3%)	2 (4.9%)	4 (9.8%)	13 (31.7%)	
Chronic diseases	None	Hematological disease	Infectious Disease	Chronic Liver Disease	Malignancy	Gastrointestinal System Bleeding History	Total	
Female	7	1	1	1	0	1	11	0.252[a]
Male	24	0	2	0	2	2	30	
	(75.6%)	(2.4%)	(7.3%)	(2.4%)	(4.9%)	(7.3%)		
Drug History	None	NSAID	Anticoagulants	Other				
Female	0	6	4	1			11	0.736[a]
Male	3	16	9	2			30	
	(7.3%)	(53.7%)	(31.7%)	(7.3%)				
Application Complaints	Hematemesis	Melena	Hematochezia	Epigastric Pain	Syncope			
Female	7	9	0	0	0		11	
Male	21	24	1	1	1		30	

[a]Pearson's chi-square test, [b]Student's t-test, SG: Study Group, CG: Control Group, SD: standard deviation; NSAID: non-steroidal anti-inflammatory drug

Table 2. Analysis of laboratory parameters

	Min	Max	Median	SD
WBC	2.67	22.18	10.74	4.13
Hemoglobin	4.20	14.00	9.21	2.32
MCV	69.30	103.10	86.08	5.84
Platelet	32.00	465.00	223.24	86.37
RDW	11.80	22.50	14.43	2.52
sCD163		Median	IQR	p-value
SG		0.786	0.490–1.157	<0.01[a]
CG		0.422	0.313–0.751	
		With bleeding (n = 24)	Without bleeding (n = 17)	
Glasgow-Blatchford Score (Median [IQR])		11 [8–13.75]	12 [10–13.5]	0.356[a]
		With bleeding (n = 24)	Without bleeding (n = 51)b	
sCD163 (Median [IQR])		0.822 [0.535–1.162]	0.506 [0.353–0.901]	0.01[a]

aMann–Whitney U test, bThose without signs of bleeding on endoscopy and the control group. SG: Study Group, CG: Control Group. WBC: white blood cells; MCV: mean corpuscular volume; RDW: red blood cell distribution width; IQR: interquartile range

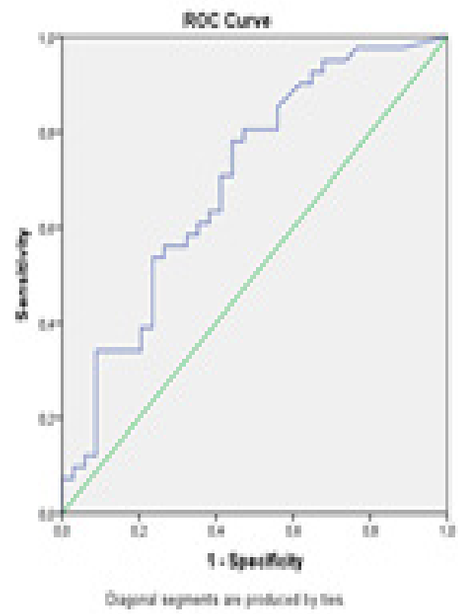

Figure 1. Representation of sCD163 by receiver operating characteristic (ROC) analysis

Table 2. ROC and Logistic regression analysis of sCD163

Cut-off Value	Sensitivity	Specificity	PPV	NPV	p-value	AUC	95% CI	
≥0.453	78.05%	55.88%	68.09%	67.86%	0.017	0.671	0.546	0.796
	β	SE	Wald	p-value	Odds Ratio		95% CI	
sCD163	0.538	0.303	3.146	0.076	1.713		0.945	3.104

PPV: positive predictive value; NPV: negative predictive value; AUC: area under the curve; CI: confidence interval; SE: standard error.

medication use history by sex. The distribution of patient history characteristics by sex showed no statistically significant difference. In the patient group, 75.6% (n = 31) had no history of chronic disease, and only 7.3% (n = 3) had GI bleeding history. In addition, 53.7% (n = 22) had a history of taking non-steroidal anti-inflammatory drugs (NSAIDs), and 31.7% (n = 13) had a history of taking anticoagulants.

Table 1 shows the distribution of the patient group's complaints by sex. The main complaint was melena (80% [n = 33]), followed by bloody vomiting (68.3% [n = 28]). Other complaints were hematochezia (2.4% [n = 1]), epigastric pain (2.4% [n = 1]) and syncope (2.4% [n = 1]).

Table 2 shows the minimum, maximum and mean laboratory values of the patient group. The minimum haemoglobin value was 4.20 g/dL, whereas the maximum was 14 g/dL, obtaining a mean haemoglobin value of 9.21 g/dL. Furthermore, the minimum WBC count was 2.67 103/mm3, whereas the maximum was 22.15 103/mm3. Thus, the mean WBC value of the patient group was 10.74 103/mm3.

In the patient group, the Glasgow-–Blatchford score and sCD163 values demonstrated no statistically significant difference between patients with and without bleeding findings. Those with an endoscopy result of Forrest score of 3 and normal were included in the group without bleeding. Bleeding signs were found in 24 patients, and none in 17 patients. The mean Glasgow-–Blatchford score of patients without bleeding was 12, which was higher than that of patients with bleeding findings. Although the Glasgow-–Blatchford score is clinically very useful, no correlation was found between patients with high scores and those with bleeding rates detected at endoscopy. Table 2 shows the bleeding findings and the values of the Glasgow-–Blatchford score and the sCD163 marker.

Moreover, the patient group had higher sCD163 levels than the healthy volunteer group, showing a statistically significant difference ($p < 0.05$) (Table 2).

Figure 1 shows the ROC analysis of the sensitivity and specificity of sCD163. Sensitivity, specificity, PPV and NPV were examined by calculating the cut-off value of sCD163 as a diagnostic marker in the examination conducted with ROC analysis. The sensitivity, specificity, PPV and NPV were 78.05%, 55.88%, 68.09% and 67.86%, respectively (Table 3). After the sCD163 results were found to be significantly different between the control group and those with and without bleeding findings, ROC and regression analyses were conducted for diagnosis confirmation. Although the difference was not significant in the regression analysis, each unit increase in sCD163 increased the bleeding risk by 1.7 times (odds ratio) (Table 3).

Discussion

In the United States, 300,000 patients are hospitalizsed yearly for upper GI bleeding. In addition, 100,000 to 150,000 patients develop upper GI bleeding during hospitalizsation [7]. Many scoring methods and guidelines are available for the diagnosis and treatment of upper GI bleeding. However, emergency medicine physicians need tools to decide between outpatient follow-up and safe discharge and between the requirement of endoscopy and observation in the emergency department.

In some studies, upper GI bleeding was more common in males than in females, and the mean age of all patients was 51-–77 years [8]. Fugarolas et al. investigated 3270 patients, and the mean age was 57 ± 16.8 years; additionally, studies conducted by Zimmerman et al. respectively [9-10]. In the present study, upper GI bleeding was also more common in males, with a mean age of 57.54 ± 2.99 years.

In patients who are diagnosed with upper GI bleeding and admitted to the emergency department, melena is generally the most common symptom on admission [11]. Lewis et al. also reported melena as the most common complaint (48%) [12]. Our study found that 80.5% of those in the patient group presented with melena and 68.3% presented with hematemesis. Thus, in our study, where some patients had more than one symptom, melena was the most common, followed by hematemesis, consistent with previous studies.

Drug use is one of the most important predisposing factors for upper GI bleeding [13]. In our study, 92.7% of those in the patient group had a history of medications that can cause upper GI bleeding, and we found NSAIDs to be the most commonly used (53.7%). In the study by Paspatis et al., 49% of patients with upper GI bleeding used NSAIDs [13]. In Turkey, Sezgin et al. found that the rate of NSAID use was 44.3% [14]. These previous results are consistent with our results.

In a study by Cheng et al. [15] Aas causes of upper GI bleeding, gastric ulcers accounted for 22% in Cheng et al.'s study, [15]. In our study, all patients from the patient group underwent endoscopy, and ulcers were detected in 90.2%. In a study by Sugawa et al., the causes of upper GI bleeding were gastric ulcer (33%), erosive gastritis (24%) and oesophageal varices (22%) [16]. Lakhwani et al. reported an incidence of peptic ulcer of 61.7% 61.7% as the rate of peptic ulcer [17]. Our study also reported peptic ulcers as the most common cause of upper GI bleeding, consistent with the literature [18].

According to Gross et al., the prevalence of ulcers by the Forrest scoring system was 18% for Forrest score 1a, 17% for 2a, 17% for 2b, 20% for 2c and 42% for 3 [19]. In Ozen et al.'s study, 3.7%, 8.9%, 10.2%, 10%, 2.3% and 64.9% of patients with bleeding ulcer had Forrest scores of 1a, 1b, 2a, 2b, 2c and 3, respectively [20]. In Cander et al.'s study, the most frequent bleeding was found in Forrest score 3, with a rate of 70% [21]. Our study identified Forrest score 3 in 31.7% of endoscopies, consistent with the previous studies. Additionally, 22% and 14.6% had Forrest scores 1b and 1a, respectively. We think that treatments used for patients until endoscopy prevent the detection of active bleeding findings.

Identifying patients' haemoglobin level upon admission is critical for the treatment, follow-up, and prognosis of upper GI bleeding. In Kocoglu et al.'s study, the initial haemoglobin levels were within 3-–18.5 g/dL, with a mean value of 9.65 ± 2.73 g/dL [22]. In oOur study,'s the mean haemoglobin value was 9.21 ± 2.32 g/dL, consistent with the previous study. Bleeding severity, anaemia presence before bleeding and prolonged hospital stay are effective on the entry haemoglobin level [22].

Compared with other scoring systems, the Glasgow-–Blatchford scoring system is more useful in predicting the need for endoscopic treatment, clinical intervention and surgery for upper GI bleeding [23]. In our study, the Glasgow-–Blatchford scores and sCD163 mean scores were calculated according

to the bleeding findings of the patient group. Waidmann et al. reported that the sCD163 level is a new independent non-invasive risk factor for death and variceal bleeding in patients with cirrhosis [24]. In a 2017 study, Fouad et al. followed up 243 patients with cirrhosis for 1 year and found that the sCD163 levels were significantly higher in patients with re-bleeding, large varicose veins or high bleeding risk. In a previous study, sCD163 correlated with hepatic venous pressure gradient and contributed to portal hypertension prediction [25]. We also investigated the level of sCD163 in patients with non-variceal upper GI bleeding and found statistical significance in the patient group compared with the healthy group.

Considering that sCD163 acts as a scavenger receptor responsible for haemoglobin sequestration, O'Reilly et al. perceived that the sCD163 levels in serum and cerebrospinal fluid in patients with intracranial haemorrhage can be used as a marker to predict poor prognosis after intracranial bleeding, peri-haematomal oedema and intracranial haemorrhage [6].

Our study has several limitations. First, in this study, patients with upper GI bleeding had chronic diseases. Although sCD163 is responsible for sequestering haemoglobin, its levels markedly increase during the inflammatory process because it is expressed in macrophages. Although people with no signs of additional illness or complaints were included in the healthy volunteer group, an inflammatory condition might have been present. Other limitations of the study include the small sample size and single-centere design.

In conclusion, although clinical intervention is critical in upper GI bleeding, early detection and prediction of the clinical course can promote early intervention and help reduce mortality. According to our study results, sCD163 may be a useful biomarker for the diagnosis of upper GI bleeding and the identification of the clinical process.

Conclusion and Limitation

sCD163 may be a useful biomarker for diagnosing upper gastrointestinal bleeding and identifying the clinical process.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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